
VIII.0 Safety, Codes & Standards Sub-Program Overview

Introduction

The Safety, Codes & Standards sub-program supports research for and facilitates the development of codes and standards for hydrogen use in transportation, stationary, and portable applications. This activity collaborates closely with government, industry, and laboratories, both nationally and internationally. It also develops and implements practices and procedures to ensure safety in the operation, handling, and use of hydrogen and hydrogen systems for all DOE-funded, Hydrogen Program projects.

Codes and standards development requires coordination of activities across government agencies, associations, corporate stakeholders, international stakeholders, and codes and standards development organizations. To this end, the sub-program leads a national effort to prepare, review, and promulgate the codes and standards needed to expedite hydrogen infrastructure development and to help enable the emergence of hydrogen as a significant energy carrier on a global scale.

The safety activity involves a large degree of external stakeholder input. Expertise is gathered from the energy, insurance, and aerospace industries, automobile manufacturers, the fire protection community, academia, and others to provide the widest possible range of perspectives on safety. Input is obtained through involvement in a variety of activities, as detailed under the Technology Status section.

Communication is also emphasized to maximize the impact of safety activities. All of the non-confidential data and information obtained through safety activities are made widely available through public presentations and the online information resources. Safety information materials, which aim to enhance the knowledge of emergency responders and local authorities having jurisdiction, are made available through various media to the greatest number of recipients possible. In addition, planning efforts supporting future activities are conducted through open workshops to ensure the engagement of interested stakeholders.

Goals

- Perform underlying research to enable codes and standards to be developed for the safe use of hydrogen in all applications.
- Facilitate the development and harmonization of domestic and international codes and standards.
- Develop and implement the practices and procedures that will ensure safety in the operation, handling and use of hydrogen and hydrogen systems for all DOE projects and utilize these practices and lessons learned to promote the safe use of hydrogen.

Objectives

- Develop a comprehensive safety plan in collaboration with industry that establishes program safety policies and guidelines by 2009. DOE will utilize the Hydrogen Safety Panel's expertise and assistance in conducting safety evaluations and identifying areas for additional research.
- Promote widespread sharing of safety-related information, procedures and lessons learned with first responders, authorities having jurisdiction, and other stakeholders.
- Support and facilitate the completion of technical specifications by the International Organization for Standardization (ISO) for bulk gaseous hydrogen refueling (TS 20012) and standards for gaseous or gaseous blend (ISO 15869) hydrogen storage by 2009.
- Support and facilitate the effort, led by the National Fire Protection Association (NFPA), to complete the draft Hydrogen Technologies Code (NFPA 2) by 2010.
- Facilitate the adoption of the most recent, available model codes (e.g., International Code Council and NFPA) in key regions through education and training for code officials.

- Complete preliminary research and development (R&D) on hydrogen release scenarios to support the establishment of setback distances in building codes and provide a sound basis for model code development and adoption.
- Support and facilitate the development of Global Technical Regulations (GTR) for hydrogen vehicle systems under the United Nations Economic Commission for Europe, World Forum for Harmonization of Vehicle Regulations and Working Party on Pollution and Energy Program (ECE-WP29/GRPE) by 2010.
- Support and facilitate the completion of necessary codes and standards needed for the early commercialization and market entry of hydrogen energy technologies by 2012.
- Develop hydrogen leak detection technologies such as sensors by 2012.

FY 2008 Technology Status

The sub-program utilizes the expertise of the Pacific Northwest National Laboratory (PNNL) Hydrogen Safety Panel to evaluate the safety plans and practices of DOE-funded projects. This activity provides recommendations on safety improvements and “lessons learned” that can be of broad benefit to the DOE Hydrogen Program. The panel, its services, and its work products are assets to funded-project teams who perform their own risk assessment and mitigation planning and are responsible for their own safe operating practices. In this manner, the panel helps to disseminate hydrogen safety best practices throughout the DOE Hydrogen Program.

To help fill the void of publicly available hydrogen safety data, the sub-program has developed and published five online hydrogen safety information resources: the Hydrogen Incidents and Lessons Learned Database, developed by PNNL, catalogs all hydrogen incidents and lessons learned at DOE-funded projects and elsewhere.¹ The Safety Bibliographic Database, developed by the National Renewable Energy Laboratory (NREL), was established in response to a recommendation from the National Research Council.² The Safety Bibliographic Database³ contains over 500 publicly available hydrogen safety-related reports, papers, and presentations, allowing researchers, code officials, and stakeholders to learn from others’ experiences. The Hydrogen Safety Best Practices Manual⁴ developed by PNNL and Los Alamos National Laboratory, contains eight hierarchical, peer-reviewed sections on best practices and is cross-referenced with the Hydrogen Incidents and Lessons Learned and Bibliographic Databases. The Permitting Compendium for Hydrogen Facilities⁵, developed by NREL is a one-stop information resource to facilitate the permitting of hydrogen fueling stations and stationary fuel cell installations. Finally, the Technical Reference for Hydrogen Compatibility of Materials⁶, developed by Sandia National Laboratories, contains a compilation of hydrogen-compatible materials and properties.

In addition, the Safety, Codes and Standards & Education sub-programs launched an online Introduction to Hydrogen Safety for First Responders course. The seven-module, web-based course provides an “awareness-level” overview of hydrogen for fire, law enforcement, and emergency medical personnel and has been accessed by over 6,700 users since its launch.

The sub-program is engaged internationally in a number of activities that span both codes and standards and safety. In addition, DOE provides support for the International Partnership for a Hydrogen Economy and the International Energy Agency, both of which have been engaged in hydrogen safety work. The DOE continues to work with the Department of Transportation to support their role as U.S. representative to the UN GTR process.

¹ This resource is available at <http://www.h2incidents.org>.

² National Research Council, *Review of the Research Program of the FreedomCAR and Fuel Partnership*, Washington, D.C.: The National Academies Press, 2005, p. 39.

³ http://www.hydrogen.energy.gov/biblio_database.html/

⁴ <http://www.h2bestpractices.org/>

⁵ <http://www.hydrogen.energy.gov/permitting/>

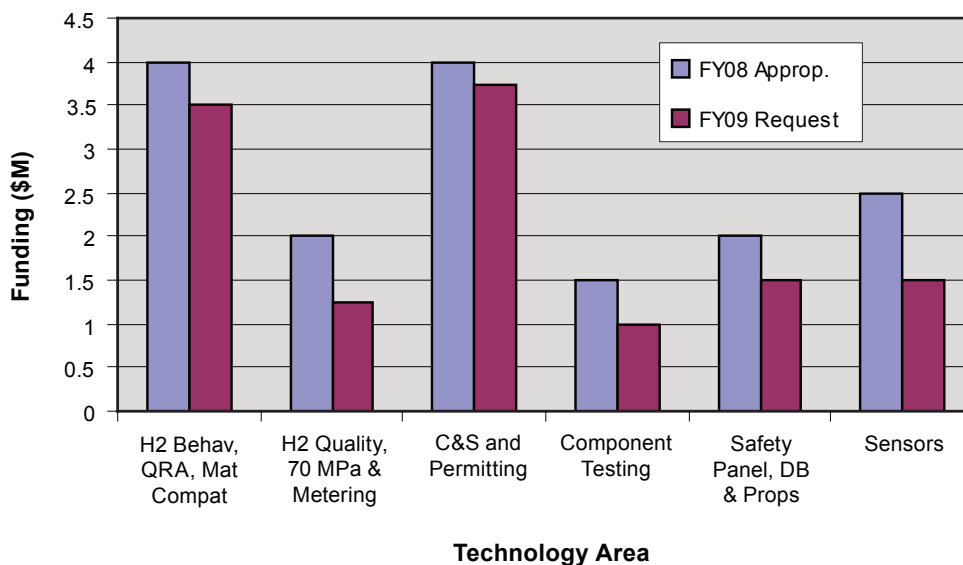
⁶ <http://www.ca.sandia.gov/matlsTechRef/>

FY 2008 Accomplishments

- Developed and released an online Permitting Compendium for Hydrogen Facilities, a one-stop information resource to facilitate the permitting of hydrogen fueling stations and stationary fuel cell installations.
- Introduced a technically traceable, risk-informed approach for separation distances for hydrogen fueling stations to the NFPA 55 code committee.
- The Hydrogen Safety Panel reviewed 34 safety plans and conducted five site visits.
- Engaged members of the building code and fire safety community in the development of safety information tools for the permitting of hydrogen fueling stations and hydrogen fuel cells for telecommunications backup power, including five regional workshops in conjunction with stakeholders.
- Updated and expanded the *Technical Reference for Hydrogen Compatibility of Materials* to include martensitic stainless steels (e.g., 400-series, 17-4 PH), semi-austenitic stainless steels (e.g., 17-7 PH), and polymers.
- Continued data generation and developed common data reporting format to support the development of an international hydrogen fuel quality specification.
- Developed safety information materials for emergency responders and authorities having jurisdiction with the Education sub-program and industry groups.
- Updated and improved the online Hydrogen Safety Databases including the Hydrogen Incidents and Lessons Learned Database, Hydrogen Safety Bibliographic Database, and the Hydrogen Safety Best Practices Manual.

Budget

The sub-program received the full budget request for Fiscal Year 2008. This funding allowed for sustained progress on hydrogen release behavior, hydrogen quality, quantitative risk assessment, and leak detection research to support the codes and standards development process. In addition, safety training activities were expanded. The budget request for FY 2009 will allow the sub-program to continue this work.



FY 2009 Plans

The Hydrogen Safety Panel will continue to promote safe practices for all DOE-funded projects by conducting safety plan reviews and site visits. Continued development of a safety information program to aid in the training of first responders and authorities having jurisdiction will be co-sponsored by the Education sub-program, with life-size training tools (“props”). Hydrogen safety information and data sharing will continue through industry collaborations, publications, and continual revisions to the Hydrogen Safety Best Practices Manual based on user feedback. A risk communication strategy will also be developed to guide officials on effective ways to communicate hydrogen risk information to the public in order to build and maintain public trust.

The Hydrogen Incidents and Lessons Learned Database will be updated and maintained in FY 2009. Future enhancements to the website will include graphical trend tools for displaying and reporting information. Cooperation with the European HySafe safety incidents database is also planned, as well as coordination with code organizations and other stakeholders.

The Technical Reference for Hydrogen Compatibility of Materials is a living document, which will continue to evolve as data are generated from materials testing and collected from the literature. Sections on pipeline steels and aluminum alloys will be added in the coming year. Additional content will be prioritized in cooperation with stakeholders, such as the American Society of Mechanical Engineers.

R&D to support the development of an international hydrogen quality standard will continue in FY 2009. Working in cooperation with the Fuel Cell sub-program, this activity will focus on fuel cell hydrogen quality requirements. The sub-program will also continue risk assessment activities and component testing work, which supports codes and standards development. In addition, the sub-program will expand R&D efforts in the area of hydrogen leak detection technologies.



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